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ABSTRACT

A longitudinal study of otitis media in young children, begun in 1981, aimed to provide information on the incidence and prevalence of otitis media in young children in the Newcastle (England) region and to follow their academic progress. Subjects selected for the study were kindergartners in five schools and represented an ethnically homogeneous sample from a range of socioeconomic populations. Repeated assessments were made for hearing acuity, middle ear status, language development, and auditory and cognitive processing skills, and a language sample was taken. The results of the original research established that, for the 210 children in the study, otitis media was not an atypical condition, as only 37 percent had shown no evidence of the condition by the end of the first year. In addition, pre-academic and academic testing supported the view that children with a chronic middle ear condition experienced more difficulties in language-related academic tasks than did their peers. The follow-up results on data gathered in 1991 indicated that these students were significantly less likely to have a positive self-perception than their peers and were more likely than their peers to have had extended school absences and to have been referred for special education assistance. When viewed over time, the results supported the value of longitudinal studies. (Contains 16 references.) (KDFB)

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LONGITUDINAL STUDIES - ARE THEY WORTH IT?

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ED 406 031

ABSTRACT

This paper focuses on a longitudinal study of otitis media in young children which was begun in 1981. The researched aimed to provide information concerning the incidence and prevalence of otitis media in young children in the Newcastle Region and to follow the academic progress of the subjects.

The results of the original research established that, for the 210 children in this study, otitis media was not an atypical condition, as only 37% had shown no evidence of the condition by the end of the first year. In addition, pre-academic and academic testing supported the view that children with a chronic middle ear condition experienced more difficulties in learning language related academic tasks than did their peers.

The follow up study conducted in 1991 gathered further data on the academic progress of some of the students who had been identified as having experienced chronic otitis media. The results provided valuable information concerning subject selection, assessment procedures and interpretation of results, when viewed over time.

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INTRODUCTION

Traditionally, most researchers consider a group of subjects, for a specific purpose, over a short, finite space of time. The advantages of such studies are obvious. They are cost effective, can be completed relatively quickly, the methodology remains in line with current thoughts in the subject area and they can result in a respectable publication, all within the space of about 12 months. All these, of course, are important in our present academic climate.

Against these advantages are those given for the longitudinal study, which centre around confirmation (or otherwise) of criteria for subject selection and the ability to observe the influence of particular variables over time. The disadvantages, however, are equally easy to identify. Subjects have an inexcusable habit of 'getting up and moving'. Testing regimes, which sounded wonderful at the beginning of the study, have a nasty habit of 'falling out of favour' and/or being replaced by bigger, better, brighter ones long before the completion of the particular research program. Then, of course, there are the problems of time and money.

The strengths of longitudinal methodology are particularly useful when problems associated with prediction are concerned. When, therefore, the Special Education program in 1980, at the then Newcastle College of Advanced Education, was confronted by a seemingly disproportionate number of children with chronic (and often previously undiagnosed) middle ear disease, a longitudinal study seemed to be the best way to proceed. The number of children with otitis media in the general population in Newcastle was unknown, posing a doubt that all children with chronic middle ear problems need special education, as suggested by some of the literature.

The situation with regard to otitis media was, at the time, far from clear. Otitis media had been the subject of research over a number of years, mostly overseas and generally with atypical

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populations such as ethnic minority groups (e.g., American Indians, Australian Aborigines) or those with particular problems, such as demonstrated learning and/or hearing difficulties. The program in Newcastle at that time appeared to 'fit' the pattern, however a number of questions remained.

A high proportion of students in need of special education at primary and secondary school level had a demonstrated history of chronic middle ear disease (80% in the Newcastle program, in the 3 year period, 1978-1980). However, did this mean that other students did not? Also of interest was the possibility that young children with chronic middle ear problems may commence school with different skills and developmental levels than their peers. If this is indeed the case, then special programs involving listening skills which foster language development may help such children.

During the years following 1980, a number of researchers continued to explore the possibility of long-term effects of repeated episodes of middle ear disease on children's ability to learn. In particular were the studies of Lous and Fiellau-Nikolajsen (1984), and those of Teele et al (1984), Klein (1986), Silva et al (1986), Share et al (1986) and of Lous (1990).

As in the research reported prior to 1983 (e.g., Friel-Patti et al, 1982), many of the results were contradictory. Lous and Fiellau (1984), for example, found no effect on the reading achievement of children with a previous history of repeated episodes of middle ear disease, while Teele et al (1984), reported small but statistically significant deficits on language tests, for children who had middle ear disease for prolonged periods of time during their first few years of life. Silva et al (1986) also reported statistically significant deficits in the reading abilities of children with a history of middle ear disease, at age five. Share et al (1986) however, reported that such effects were small and that there did not appear to be an excess of children with histories of middle ear disease among those with severe difficulties in reading.

The research concerned with the effects of middle ear disease in infants is likewise confusing. Klein (1986) reported that population surveys found that 30-40% of children experienced three or more episodes of otitis media during their first few years of life. Friel et al (1982) monitored the hearing status of 35 infants during their first two years of life. Results reported indicated that 71.5% of those with recurrent episodes of otitis media demonstrated language development scores of six or more months below age level. Roberts et al (1986) however, failed to replicate these results.

In 1990, Friel-Patti and Finitzo reported the results of their study of 483 children. These results indicated significant effects on language development of the hearing loss, often associated with episodes of otitis media, during the first two years of a child's life. These effects, however, appeared to be small. The authors also reported that they had not found significant numbers of otitis-prone children with clinically delayed language.

Such conflicting results are confusing. Bishop and Edmundson (1986) however, suggested that two factors seemed to be important in determining whether or not language deficits would be associated with otitis media. These factors were the child's hearing status at the time of any assessment and whether any other risk factors for language impairment were present.

Grunwell (1992:216) claimed, in her paper on remediation of children with phonological disorders, that many children had a history of mild hearing problems due to otitis media with effusion. Such children, she stated, 'have detectable cognitive-linguistic deficits in both comprehension and production. Their educational progress is often slow and they may exhibit attention problems'.

This research, then, leads back to the study in the Hunter Region (Cowley, 1985), which was 'revisited' in 1990.

The original study (1981-1983) involved a multi-disciplinary team of researchers, a practice not common in Australia at that time. The team included researchers from the National Acoustic Laboratory, Sydney, the Department of Linguistics at the University of Newcastle, The Special Education Centre at the then Newcastle College of Advanced Education as well as representatives from the Hunter Region Departments of School Education and Health (Cowley, 1985).

The study was designed to provide the following information:

- the incidence of middle ear disease in Kindergarten children in five schools in the Hunter Region in 1981;
- a comparison of the level of performance of children with a history of middle ear disease with that of their peers without such a history, in areas such as auditory and cognitive processing, language development and, later, in reading; and
- any possible links which could be demonstrated between middle ear disease and environment and/or socio-economic status.

The hypotheses predicted that the incidence of otitis media in the Newcastle region would be high; that there would be a positive link between this incidence and the environment and/or socio-economic status of the families of the children; and that there would be differences in the language and learning abilities of those children with chronic middle ear disease and those with no apparent problem.

The subjects selected for the study were all children in each of five schools, who were enrolled in the Kindergarten classes by 30 May 1981, and who had received parental permission to take part in the research (N=210). The schools were selected on the basis of ethnic homogeneity and to represent a range of socio-economic populations, together with a range of environments (e.g., lakeside, rural, urban and industrial).

All children had repeated assessment for hearing acuity and middle ear status, over the full school year. They were also assessed in language development and for auditory and cognitive processing skills. In addition to standardised and criterion referenced assessments, a 30 minute language sample was collected from each of the children by the Speech Pathologists. Each language sample was then transcribed and reviewed to provide a measure of each child's use of language.

The initial assessment regime was completed by December, 1981. It provided an indication of each child's language, preliteracy and auditory processing skills, together with their middle ear status. The regime involved two audiologists from the National Acoustic Laboratory, Sydney, one speech pathologist, two special educators, class teachers and parents. The children were then retested at the end of 1982 and 1983 to assess their academic progress.

TABLE 1
MIDDLE EAR STATUS, DECEMBER 1981

Chronic otitis media	48
Indeterminant status	122
Clear	40
Age range: 4yrs 6mths - 6yrs	

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The results at this time were interesting. The major ones were:

- only 37% (40 children) showed no evidence of middle ear disease during 1981, supporting the view that otitis media should not be seen as an atypical condition in early childhood, in the Newcastle/Lake Macquarie region (Table 1);

- no links were demonstrated between middle ear and environment and/or socio-economic status;

- the children who failed the audiometric testing on at least two consecutive occasions, the Experimental Group (N=48), were found to experience more difficulties with auditory processing and reading tasks than did their peers, when matched for gender, cognitive processing and language skills;

- children in the Experimental Group were also found to use their expressive language skills differently to most of their peers. They were observed to use only simple language structures with few embellishments such as adjectives, adverbs, descriptive phrases or subordinate clauses, nor to ask questions to gain information or to clarify possible misunderstandings; and

- the level of expressive language ability with which the children entered formal school (i.e., at age 5, in NSW) appeared to have important implications for subsequent academic progress. Such correlations were not demonstrated to the same degree for the receptive language assessment component.

Given the above findings, it was concerning that neither early childhood teachers nor the parents of children who presented with language delay demonstrated clear knowledge of appropriate action to help the children. Typically, parents enrolled the children in an early childhood centre, on the basis that:

If my child really has a problem, the teachers will tell me about it. (Parent interview)

Teachers, on the other hand, were reluctant to question language development too deeply, as they were unaware of any reliable testing procedures, speech pathologists were rarely available, and:

Children generally grow out of such problems. (Teacher Questionnaire)

The findings also questioned both teaching and medical practice and understanding of the problems raised. In particular, the advisability of accepting middle ear disease as medical in nature and implication alone, was viewed with great concern.

The conclusions suggested that the children with a history of repeated middle ear disease, with effusion, appeared to have developed different strategies for listening, learning and language use than had their peers who did not have such a history. Further, such different strategies, it was suggested, often proved inadequate when the children moved from a home or pre-school (3 to 5 year olds) setting, into the more formal environment of compulsory schooling.

The scene revisited

It was not possible, in 1990, to assess and interview all the children involved in the initial study (time and money, yet again). It was decided, however, to attempt to locate and retest the pairs of

matched subjects. The pairs originally differed only in their middle ear status, using the parameters of the research.

Immediately problems began to surface. As a result of time, the economic situation and the Newcastle earthquake, the children did not always prove easy to locate and some had to be posted 'missing'. Thirty two children were located, however with another difficulty quickly surfacing. Of the sixteen matched pairs, four had become unmatched, as the Control Subject, in each case, was found to have had grommets inserted by Year 3, thus placing the students in the 'chronic middle ear status category, rather than in the Control' ('Clear') as previously (Table 2).

TABLE 2
MIDDLE EAR STATUS

	1981	1990
Chronic otitis media	48	25
Indeterminant status	122	122
Clear	40	36*

* Represents maximum possible figure

All children were assessed for reading ability and for their attitudes to both themselves and to school. The school record cards were accessed, in order to provide background information on school attendance patterns and overall academic progression through the grades.

RESULTS

The results showed that the students from the Experimental Group were significantly less likely to have a positive perception of themselves and of their academic ability than were their peers ($p<0.05$) and were much more likely to have had extended absences from school. In all except one case, each of these students had seventy or more days absent over the nine years, compared to the average of 52 days for the whole group, and four of the students had repeated a year, where no student had repeated from the Control Group. In addition, all but two students in the Experimental Group had been referred for special education assistance, while only three students had been so referred from the Control Group.

It was also of interest to note that, of the students who initially presented with poor expressive language skills, none achieved a Reading Age within two years of their chronological age. This was unrelated to the middle ear status of the students and a similar correlation with Receptive Language performance continued to be absent.

DISCUSSION OF THE LONGITUDINAL STUDY RESULTS

The implications of these results are of particular importance in three main areas: subject selection, assessment procedures and interpretation of results.

Subject Selection

In this particular study, the difficulties inherent in the selection of control and experimental subjects in such research are highlighted. Only sixteen of the original twenty four matched pairs of subjects

were located for the follow-up study and, of the sixteen subjects judged in the previous audiometric assessments to be free of middle ear disease, four were found, during the follow-up research, to have had sufficient episodes of otitis media to warrant the insertion of grommets. A further two were found, during interview, to have experienced at least two episodes, requiring less intrusive treatment.

When considered in context, this leaves a possible 34 students out of the original 210 (i.e., 16%) with no reported middle ear involvement. This in itself makes generalisation from the many reported studies difficult, given that subject selection is often undertaken through parent or teacher interview, special education referral or by single audiometric testing procedures.

Where otitis media continues to present as a common childhood ailment, often undiagnosed, the selection of any 'control' group for research appears difficult.

In 1981, it was unusual to collect language samples, in different settings, from children for analysis in educational research. Although often difficult and always time consuming, both intervening research in early childhood, together with the longitudinal results of this study, support the view that these procedures are valuable. Such value lies within the implications for other language learning related areas such as early literacy and numeracy, in addition to factors relating to more immediate Early Intervention programs.

The present study also underlines the importance of multiple audiometric measures to determine the hearing and middle ear status of young children. It has been demonstrated both in this study and in subsequent research and experience, that such status is subject to change, over time, with inherent difficulties both in an educational and medical sense, as well as in subject selection for research.

Interpretation of Results

One advantage of this longitudinal study, has been to focus attention on the possible long term effects of children's abilities at entry to compulsory school settings, on their later academic progression.

An important finding in the initial study has gained further strength through the 1990 research. Where young children develop ineffective learning strategies before entry to formal school, they appear unable to change these strategies sufficiently to effectively improve their learning, without help. This view has found additional support through the work of Ashman and Elkins (1994) and their colleagues.

Discussion

The implications of the 1985 and 1990 studies for early childhood educators are important. Given recent findings that 9% of infants will have an episode of otitis media by 3 months of age (Maxon et al, 1993), staff in early childhood services need to become aware of methods to ameliorate the effects, both known and suspected, of middle ear disease.

The Maxon et al study highlights concern with conductive hearing loss, due to otitis media, in addition to factors such as the heightened exposure to infectious diseases of children in day care centres. Concern is also expressed about the increased number of infants who are bottle, rather than breast fed, which in turn contributes to an increased risk of developing otitis media. Interestingly, this greater risk relate primarily to the feeding position, rather than to an added susceptibility to infectious diseases.

While the implications for infants and toddlers are important to note, it is also important to recognise the findings which refer to children up to at least the age of eight years. There is a growing volume of research data, including the studies reported in this paper which suggests that

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at any one time 25% of children in early childhood programs may not be hearing properly. This fact has important implications for health, safety, educational planning and programming. Related to this also that which suggests that children experiencing chronic middle ear disease develop ineffective expressive language and learning strategies before entry to formal school, which then reflect in poor academic performance.

Recent research in the Hunter Valley has provided additional data concerning the incidence of hearing difficulties in young school aged children and the ability of their teachers to identify such difficulties and to provide effective programs for their children (Hayden, 1994). This particular study surveyed fifty two teachers, in a number of pre and primary schools, in order to establish their knowledge of sensory disabilities and the effects of such disabilities on child development, health and learning. This information was then discussed in the context of the results of the school health screening program, conducted by the local community health service in these particular schools during 1994 (Table 3).

TABLE 3
RESULTS OF THE LOWER HUNTER COMMUNITY HEALTH SERVICES 1994
SCHOOL SCREENING PROGRAM FOR HEARING ACUITY

No. of children screened	3,465
Age Range	4 to 12 years
Hearing defects identified	230

While there was some variation in the incidence of disabilities identified in various schools, the teachers participating in the study all expressed their concern at the number of children identified by the health service as presenting with a sensory disability (47% of the classroom population of teachers who completed the survey). This concern was reflected in both the 100% return rate of survey forms and agreement for interview.

The survey indicated that, of the fifty two teachers participating, thirty seven had one or more children in their class identified in the screen as having a problem, with twenty one of those teachers reporting that they had failed to detect that problem in the child or children concerned. Of those identified with hearing difficulties, the majority of the children in preschool and kindergarten were suspected of having middle ear disease as the cause of the hearing loss.

More than 60% of teachers participating in the survey reported that they were unable to:

- detect any problem with hearing or related speech difficulties;
- notice any behavioural characteristics, visual or auditory; or
- detect specific developmental problems or abnormalities in speech or in the voice quality of the children whom they taught.

Although the majority of the children assessed were in the 4 to 6 year age range, it is of particular concern to note that a small proportion of the population with a sensory disability detected for the first time in the 1994 screening program, were in year six. As this indicates that these students had been attending school for at least seven years with such difficulties unidentified, questions relating to the follow up of children missed during the screen in their first year of school need to be carefully considered.

As in findings reported in previous research (e.g., Collins, 1984; Gow, 1989), the teachers in the Hayden study commented on the need for additional professional development, access to resources and to specialist teachers and therapists, in the area of sensory disability. Without such additional support, the teachers indicated a lack of confidence in their ability to either identify children with potential difficulties in sensory development, or to cater adequately for their needs in the regular classroom.

CONCLUSION

The findings of both the Hayden study (1994) and of the reported longitudinal study are important for both theory and practice.

The longitudinal study provides support for previous research indicating possible long term effects of early chronic otitis media. Despite the difficulties which such studies pose, the process is a valuable one, as it allows for more informed conclusions to be drawn about subject selection, testing regimes and educational programs. It also facilitates, for later studies, a more confident selection of subjects and assessment procedures.

The findings of the Hayden study, however, indicate the dangers inherent in the belief that teachers in both the early childhood and primary sectors of education are sufficiently knowledgable about the indicators of hearing difficulties, of suitable action to take where such a difficulty is suspected and of the implementation of appropriate teaching and learning strategies to facilitate the education of children with such difficulties.

Within the area of middle ear disease, the future is brighter for our children in 1995 than it was in 1983. Medical and educational professional education programs now acknowledge the transdisciplinary nature of both the problems of and solutions to many language and learning difficulties. Such an attitude can only lead to better and more effective research in the area and, in turn, to better and more effective intervention programs. It is important, however, not to lose sight of the fact that the quality of such programs relates directly to the knowledge and skills of those professionals within them and to the availability of effective support services and practical resources.

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